(2) In 1671, Leibniz sent the *Hypothesis* to Henry Oldenburg and the Royal Society. In the ensuing correspondence, Oldenburg presented Leibniz with a few remarks by John Wallis and pushed Leibniz to reconsider the main assumptions of his theory.[67] Leibniz's notes to this effect witness a momentous conceptual shift.[68] In sharpening his definitions of matter and space, Leibniz arrived at the conclusion that, since matter is space endowed with resistance and resistance is caused by motion, matter is *nothing but motion*. He abandoned the view that there are two things—space as a container and matter as what is in it. In this new account, there is a single extension, which is called matter when it moves (and thus resists penetration) and space when it is at rest (and thus perfectly penetrable). A modern (anachronistic) representation of Leibniz's physics in this period may be that of a force field, in which waves (i.e. motions) are regarded as material particles and the unperturbed field as an empty space. Leibniz's own metaphor is that of a *net* which acquires different shapes when is folded.[69]

Leibniz happily explained his discovery to Oldenburg:

> I prove that the essence of a body needs something more than extension (that is, magnitude and figure), otherwise it would not differ from space. I also show that this cannot be anything but motion. I can thus prove the following propositions, which have a certain relevance in philosophy: (1) there is a vacuum; (2) what is at rest, is empty space . . . .[70]

Leibniz stressed that space (i.e. immobile matter) has real existence and bragged to Oldenburg that he had been able to *prove* that there is a vacuum. In the same months, Leibniz engaged in a correspondence on space and vacuum with Otto von Guericke.[71]

[67] Oldenburg to Leibniz, 12/22 June 1671; A II, 1, N. 68, 216–21.

[68] These are presented in Leibniz's *Specimen demonstrationum de natura rerum corporearum ex phaenomenis*, which offers new definitions of space and matter through a recourse to motion and clear and distinct perception. See, for instance, 'Spatium est extensum quod sentimus nos mutabile intelligere (id est distincte cogitare) non posse. Hinc sequitur spatium esse immutabile. Quia omnis sensus cogitationis nostrae verùs est . . . . Corpus est extensum quod sentimus nos mutabile intelligere posse. Corpus est mutabile' (A VI, 2, N. 45_2, 307).

[69] Leibniz's metaphor of the net comes from a text of 1676 in A VI, 3, N. 74, 519.

[70] Leibniz to Oldenburg, 15/25 October 1671; A II, 1, N. 87, 278.

[71] See especially Leibniz to Oldenburg, 8 September 1670 (A II, 1, N. 28, 104). Leibniz's most important letter to Guericke, in which he discussed Guericke's robust ontology of space, is dated 17 August 1671 (A II, 1, N. 75, 238–43). Guericke called a vacuum '*spatium purum*' in his letter to Leibniz of 6/16 June 1671 (A II, 1, N. 62, 202).

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(3) In March 1672, Leibniz arrived in Paris. His exchanges with the international community of scientists working there convinced him that there is no vacuum in nature, and he quickly disowned the views that he had wholeheartedly endorsed a few months earlier. In the framework of Leibniz's natural philosophy, this meant that every part of extension is in motion, and therefore there is matter and resistance everywhere.

> The notion of a vacuum originates from a false notion of place or space, just as the notion of penetration originates from a false notion of matter—which deceived me for a long time. Indeed, initially it may come to mind that space is an immobile substance, like a universal vessel. And that body is something posited in space that, besides extension (which is common to space as well), also possesses ἀντιτυπία, that it is to say impenetrability with respect to other bodies. . . .
>
> I have enquired deeper. . . .
>
> It is clear that matter does not consist in extension, but in motion, and a great amount of matter is nothing but a great amount of motion.[72]

It may be said, then, that by 1672 Leibniz had rejected space as an independent and self-subsistent entity. Leibniz's metaphysics of nature assumed the existence of a single, material *res extensa* which is impenetrable everywhere (in different degrees) by virtue of the motion of all its parts. There is no vacuum, and there is no need for a second, penetrable extension that acts as a container for matter. Space has no independent role to play in this metaphysics. In the same years, Leibniz approvingly quoted Hobbes's idea that space is a mere product of imagination.[73]

It would be a mistake, however, to conclude that space was entirely a mental construct for Leibniz. Indeed, at the end of his stay in Paris, Leibniz introduced the notion of divine immensity. In a text from 1676, heavily inspired by Spinoza, Leibniz took space to be changeable, since he identified it with a corporeal extension and said that this physical space, insofar as it is composed of different bodies and parts of matter, should be considered an *ens per aggregationem*. Beyond all the bodily changes, however, there is something

[72] These claims are from the *Propositiones quaedam physicae*, in A VI, 3, N. 2_3, 55–6. The main passage continues with some important considerations on the relation between existence and perception that are not relevant in the present context. Later in the same period, Leibniz advanced arguments against empty space grounded on the composition of the continuum (*De minimo et maximo*, in A VI, 3, N. 5, 97–101).

[73] See A VI, 3, N. 19, 279 ('Hobbius enim Locum vocat phantasma existentiae').

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